The Chemical Age

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Microanalysis

IT is recorded that not so many years ago, when an old ironmaster was asked by a chemist in the steel-works to which he sold his iron : " How is your phosphorus running ?" with an uncomprehending and contemptuous stare he replied : " What the hell is phosphorus anyway ?" The stare of the industrial chemist when asked whether he uses microanalytical methods will certainly not be contemptuous—rather the reverse—but it will often be uncomprehending. The truth of the matter is that a technique of microanalytical methods has been evolved, and the textbooks on the subject are few, so that the average industrial chemist has little opportunity of keeping himself up to date in this strange new Alice-in-Wonderland technique, and still less of practising it. Industrial laboratories are not a little shy of microanalysis, and it was noticeable that when Miss I. H. Hadfield gave her paper on the subject of " Microanalytical Methods as Applied to Inorganic Substances," those who took part in the subsequent discussion did not appear to have any practical experience of the methods described. In short, for the majority of chemists Miss Hadfield broke new ground, and the Society of Chemical Industry is to be congratulated upon hearing so valuable a paper.

Microanalytical methods may be divided into three groups. There is first a group which may be called sub-micro, in which the scale of operations is about one-hundredth of that of the usual microanalytical methods, *i.e.*, whereas in the usual methods the standard of weight is the gram, in the sub-micro methods the standard is the centigram. These methods are similar to those of the macro-methods, but the size of the apparatus is reduced to about one-hundredth of the usual size. At the other end of the scale are the microscopic methods in which the reactions take place on the microscope slide, often with the aid of a micro-manipulator, and in which reagents are sought that will produce distinctive crystal forms observable and identifiable under the microscope. This form of microanalysis is not less than 60 years old. Between these lies the new technique that was the subject of Miss Hadfield's address in which the apparatus used is of capillary type, and the unit of weight is the " gamma," or 0.001 mgm. ; here in short, the scale of operations is one-millionth of that of the usual macroanalysis.

It would be obviously impossible to attempt to describe here the elaborate technique that Miss Hadfield so graphically illustrated. The balance presents the first difficulty. It must obviously be of extreme sensitivity. It may weight a total of 2 gm., perhaps, when apparatus containing a precipitate is put on the scale; the 0.001 mgm. is obtained by the rider, and sub-multiples of this, 0.0001 and 0.00001, are found from the swing of the pointer. This swing may not be accurate, and it may vary from time to time. The readings will be thrown hopelessly out by the smallest thermal change, such as would be made by opening the balance door; or by a change in the humidity of the balance atmosphere; or by electrostatic charges. To the uninstructed observer the difficulty of weighing appears likely to be very considerable. The precipitations are conducted in special microvessels from which the liquids are drawn through a " filter-stick " permitting of infinite variations of design, in the filter-bed of which the precipitates are retained. How the microchemist persuades his precipitates not to adhere to the glass sides of the precipitation vessel must remain a profound mystery to the macrochemist who is used to wielding his "policeman," until it is explained that by washing with various different liquids, such as would be feasible on the microscale, the precipitates may be induced to give themselves up without fetching the " policeman." Burettes, too, appear to be capable of misbehaving themselves in " *n* " different ways until the right technique for use and design is discovered.

Yet with all the difficulties of technique, microanalysis, first introduced through the demands of biology and medicine, is proving itself a valuable weapon in industrial work. Agriculture, mineralogy and engineering are making use of it. Very small quantities of material can be investigated; a secretion, a microscopic fragment, a small smudge on a contact point in electrical work, a microscopic speck on the seat of a needle valve, a film of gum on a bearing surface, a single minute pit in a piece of metal, and so forth. Many engineering failures are due to segregation, and here the minute samples investigated are of particular value. A vast variety of problems may be tackled by the microchemist with success that could not be attempted by other methods because a sufficiently large sample could not be obtained. Particular care is necessary in sampling, since segregation plays so large a part, and here Miss Hadfield showed that in such work as the microanalysis of coal the precaution must be still finer grinding of the sample, so that the same number of particles should be taken when weighing 1 gm. of coal for the macro test and when weighing perhaps 1 or 10 mgm. for a micro test. It would appear that microanalysis has come to stay and that it is suitable for industrial work, provided that a specialist is retained to work upon it. It is not a method to be entrusted to those without experience of the pitfalls.

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NOTES AND COMMENTS

Nylon Manufacture in Great Britain

EXCELLENT progress is being made with the three factories which are being built in England for the manufacture of Nylon. Of these one, which will produce the "polymer" or raw material, is being erected at Huddersfield by the I.C.I. Dyestuffs Group. The other two, both of which will be engaged in converting the raw material into the intermediate products, monofil and yarn, which will be sold to their respective industries, are at the works of I.C.I. (Plastics), Ltd., Welwyn Garden City, and at British Nylon Spinners, Ltd., a joint company formed by Imperial Chemical Industries, Ltd., and Courtaulds, Ltd., whose factory will be at Coventry. All these factories are being pushed on as rapidly as possible and a later announcement will be made regarding the dates when the materials are likely to be available for the market. As nylon is a generic term given to a group of products derived ultimately from coal, air and water, its production in Great Britain is of particular significance at the present moment.

Fluorescent and Luminous Pigments

IN the last few months a number of interesting, though not altogether accurate, articles on the above subject have appeared in journals catering for the paint trade. The general impression given by these articles is that the manufacture of such pigments is not so difficult as was at first supposed, and this is in part true. Any chemist, given the published formulae and manufacturing details of fluorescent zinc or alkaline earth sulphides, and possessing a little experience in high temperature technique, can produce luminous and fluorescent pigments of a sort. But there is all the difference in the world between this and the production of these compounds with the highest standard of brightness and in commercial quantities. Traces of impurities and small changes in technique have such a profound effect on the quality of the finished pigment that in no production is it more essential to have the constant supervision of a chemist long experienced in the commercial as well as the laboratory practice. Moreover, in addition to the commercial production of luminous sulphides, there is open to the industrial chemist another range of chemicals used in discharge tubes and X-ray screens, which can be manufactured only when the same elaborate precautions have been observed with purity and control. A great deal of experimental work has been done investigating the properties of silicates, tungstates, phosphates, borates, etc., when activated in a discharge tube, the results of which manifest themselves in the multicoloured effects obtainable in tubular discharge lighting. Although the black-out has curtailed the possibility of the use of these compounds in Great Britain, inquiries may well be made from overseas not only for the sulphides but also for the discharge tube chemicals. Messrs. Thomas Tyrer will welcome any such inquiries and will endeavour to supply any technical information that may be required.

Trades Disputes Act

THE General Council of the Trades Union Congress have been pressing the Government to amend the Trades Disputes Act of 1927. Public opinion will assuredly deplore the raising of such a highly controversial issue as this in war-time, more especially as a truce between political parties has been proclaimed. The Prime Minister could have given no other answer than the one he gave—a request to trade unionists not to press for reconsideration of the matter during the war. There is no doubt that the political end of trade unionism has all along resented the terms of the Trades Disputes Act. Among other things it substituted "contracting in" for "contracting out" of payment of a political levy sanctioned by a trade union ballot. That was no more than safeguarding the liberty of the individual trade unionist, which is, after all, part of the general liberty for which the second great war is being fought. The Act debarred Civil Servants' Unions from being affiliated to the Trades Union Congress, and put a stop to the intimidating weapon of mass picketing. It can hardly be suggested that the reversal of these provisions or even the discussion of it, is likely to strengthen the hands of British industry in the successful prosecution of the war. This is no time for political agitation on subjects on which trade unionists themselves are very far from being agreed.

Containers

WE have often insisted in these columns on the importance of adequately strong containers for chemical products. There is not only the deterioration of the chemicals themselves that has to be considered, in the event of a leak of air or moisture from the outside, but it must also be remembered that an unexpected discharge of oily, corrosive or strong-smelling material from a faulty package can damage or destroy the contents of neighbouring consignments. Only the other day a case was brought to our notice of a badly-packed consignment or oranges—a relatively harmless commodity—bursting on to a load of eggs and completely ruining their flavour. How much more careful, then, should manufacturers of chemicals be when shipping their own more pungent products. Special attention to this matter is essential nowadays. We are rightly urged to develop British export trade; and exports to many neutral states are subject to special controls, resulting in an extra number of handling processes. Containers which may have been able to stand up to the normal processes of peace-time transport may fail when faced with the vicissitudes of war-time handling. In fact, we have information that they do fail, much to the inconvenience of the transport authorities. It is not, therefore, as idle as it appears to remind chemical manufacturers that there are in this country numerous firms who specialise in making containers of all kinds and sizes.

SELF-LUMINOUS MATERIALS AND THEIR UTILISATION

Zinc Sulphide and Alkaline Earth Phosphors

By
LEONARD LEVY, M.A., D.Sc., F.I.C., and DONALD W. WEST, A.C.G.I., A.I.C.

THE war and the black-out regulations occasioned thereby have focussed attention upon materials which are self-luminous in the dark, and can thus serve as indicators, etc. Such bodies emit visible light without the simultaneous emission of any sensible amount of heat radiation. Self-luminous bodies of this description can be classified under four main types.

(1) Materials which are luminous as a result of chemical action, the latter being accompanied by the evolution of light instead of heat only, as is usually the case when energy is evolved as the result of chemical reaction. Phosphorus is the best known example of this type of material—it emits light when slowly oxidised. This phenomenon is conveniently displayed if the phosphorus is dissolved in certain essential oils; the solution glows brightly when shaken up with a little air. This type of luminescent material is known as chemi-luminescent.

(2) The second type of self-luminous material is exemplified by a large number of living organisms of various types, which emit light and are thus self-luminous in the dark. Glow-worms and many marine organisms are examples of this class. The phenomenon is known as bio-luminescence, and is simply a special variety of the chemi-luminescence described above. The light-giving body consists of an oxidisable material which becomes luminous during oxidation. Chemi- and bio-luminescent materials are of no practical importance and will not be further considered.

(3) The third type of self-luminous material is radio-active luminous compound, well known for its use in luminising watch and clock dials, etc.

(4) Certain specially prepared materials emit luminescent radiation after exposure to radiation of various types. These are generally known as phosphors, and are of special interest owing to their present and prospective uses during black-out periods.

Radio-Active Luminous Compound

Radio-active luminous compounds were well known before the Great War, and were largely used during the war for illuminating the dials of aeroplane instruments and for the manufacture of gun-sights for night firing. The compound consists of a very small quantity of radio-active material mixed with a large bulk of a specially prepared phosphor. By far the best substance for this purpose is a specially prepared zinc sulphide. This responds very well to the α-radiation, which is responsible for well over 90 per cent. of the total energy evolved. No other substance has yet been discovered which is anything like as effective in converting this radio-active energy into light.

During the Great War the Admiralty standard for radio-active luminous compound was 0.4 mgm. per gram of zinc sulphide. Improvements in the zinc sulphide effected during the last 20 years have led to a considerable reduction in the amount of radio-active material employed without any loss of luminosity. With the best zinc sulphide phosphor now obtainable more illumination is developed from compounds containing less than half this amount of radio-active matter. This has a dual advantage; not only is the cost greatly reduced, as the expense is nearly all due to the content of radio-active material, but the life of the compound is greatly increased. It is an unfortunate fact that the α-ray bombardment of the zinc sulphide results in a destruction of the active centres, and the luminosity greatly decreases. The rate of decrease is much greater with relatively high concentrations of radio-active material, and thus the reduction of radio-active content which can now be achieved means that the effective life of the compound is considerably increased.[1]

Apart from the improvement in the zinc sulphide phosphor the only other change that has been effected in this material since the last war is the substitution of part or all of the radium salt previously employed by mesothorium. The α-ray activity of pure radium reaches a maximum one month after it has been extracted, and thereafter remains constant. The α-ray activity of mesothorium, on the other hand, continually increases after it has been extracted and reaches a maximum value 4.6 years later. In the case of mesothorium luminous compound therefore, the decay in the activity of the zinc sulphide is largely offset by the gradual increase in the activity of the mesothorium. If the luminosities of preparations containing exactly similar amounts of radium and mesothorium are measured at intervals, it will be found that the luminosity of the radium compound is very distinctly higher than that of the mesothorium compound initially, but continually diminishes. The luminosity of the mesothorium compound remains substantially constant, and the two curves cross after an interval of 300 days.[2] The exact time at which the curves cross depends upon the amount of radio-active material in the compound.

Required for Government Work

Radio-active luminous compound required for Government work is very carefully controlled, and has to fulfil a very rigid specification both as regards γ-activity and luminosity. Luminous compound used for clocks and dials is a very inferior grade of material; it consists merely of a very small amount of radio-active matter, which is usually radio-thorium grown from mesothorium solutions and removed therefrom.

The class of self-luminous bodies with which this communication is particularly concerned is a special type of so-called luminescent substance. When radiation falls upon a body and is absorbed thereby, generally speaking it is converted into heat. In certain instances, however, the incident radiation is largely converted into visible luminous radiation, this phenomenon being known as fluorescence. In some cases the emission of light does not cease with the cessation of the incident radiation, but is emitted for a greater or less period afterwards. Energy has been stored in the molecule and is gradually emitted in the form of light. This phenomenon is known as phosphorescence and it is only with substances which display phosphorescence as well as fluorescence that we are now concerned.

The phenomena of fluorescence and phosphorescence are shown graphically in Fig. 1.[3] When radiation falls upon a luminescent substance the intensity of the emitted light increases rapidly to a maximum; it then remains substantially constant (with certain exceptions into which it is not now necessary to enter) until the incident radiation ceases, when the intensity falls. If it falls almost instantaneously to zero, phosphorescence is absent. In the case of phosphorescence the intensity decays in accordance with an exponential curve, as shown on the diagram. The slope of this decay curve varies very greatly with different preparations.

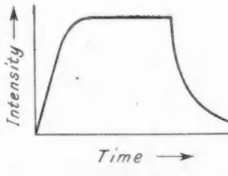


Fig. 1.

Although certain natural minerals display strong luminescent effects, the most striking effects are invariably displayed by artificially prepared bodies, specially made for the purpose in view. Such artificially prepared luminescent substances are commonly called phosphors, and their preparation is a very skilled branch of inorganic chemistry. Without going into detail, certain principles which must be followed in the preparation of phosphors are now well known. The phosphor must be in a very high degree of purity. Very small traces of unwanted impurities greatly depreciate its luminescent qualities and this is true both of fluorescent and phosphorescent effects. For example, the authors have found that the addition of only one part in one million, or even less, of nickel to zinc sulphide phosphor largely destroys the phosphorescence, without greatly affecting the fluorescence. This phenomenon has been made use of in the production of phosphors for X-rays and television, in which phosphorescence must be completely absent. Other impurities are detrimental both to the fluorescence and the phosphorescence; for example iron, cobalt and vanadium in zinc and zinc cadmium sulphide phosphors.[4] Although the absence of these unwanted impurities is essential, the presence of other activators in very small quantities, of the order of one in 10,000 to one in 50,000, or less, is necessary for the full development of the luminescent qualities. These activators are known as phosphorogens.

As already stated, the slope of the decay curve of the phosphor varies greatly with different preparations, and different types of phosphorescence, or " afterglow " as it is often called, are required for various purposes. In certain instances it is necessary that the stored up energy should be emitted very rapidly, thus giving a " burst " of phosphorescence, persisting for perhaps a fraction of a second, which is not much inferior in intensity to the fluorescence. An example of the utility of this type of phosphorescence is afforded in the use of phosphors in gas discharge tubes. The short sharp burst of phosphorescent light helps to bridge over the period between the alternations, and thus assists to some extent in the elimination of flicker when a fast moving object is observed.

The other type of phosphorescence which is now of interest owing to the existence of the black-out is one of long duration in which the phosphor continues to emit light for long periods after the exciting radiation has ceased to function. In this instance the most satisfactory material is the one that is capable of storing the maximum amount of energy, which is subsequently emitted in the form of light.

There are two types of luminescent material which display phosphorescence of long duration. These are sulphides of the alkaline earths and zinc sulphide. These two types differ markedly in their luminescent and chemical properties, and as a result both have their preferred uses.

Alkaline Earth Phosphors

The first luminescent material of which there is any record was actually an alkaline earth sulphide. In 1602 a cobbler of Bologna strongly heated mineral barium sulphate and obtained a material which glowed in the dark. It was therefore called Bolognian phosphorus. The barium sulphate must have contained some reducing agent, thus resulting in the formation of a certain amount of barium sulphide. Even when prepared according to the latest modern technique barium sulphide does not, however, display luminescent properties of any particular interest. It displays an orange coloured fluorescence with an afterglow of the same colour, both being of poor intensity. The phosphorescence is also not of very long duration. Up to the present, therefore, the substance is of historical interest only.

The initial intensity of the phosphorescence of the best alkaline earth phosphors is not so great as that displayed by zinc and zinc cadmium sulphides. The decay curves, however, cross in about one minute, after which the intensity of the phosphorescence is much greater than that of the zinc sulphide type (see Fig. 2). The intensity of the phosphorescence is sufficiently great to be of real utility more than 12 hours after the final exposure to light, and is perceptible to a well-rested eye several days after.

The colour of the phosphorescence is often the same as that of the fluorescence. This is in contradistinction to the zinc sulphide phosphors, in which the phosphorescence is always of greater wave-length than that of the fluorescence.

The intensity of the fluorescence of the alkaline earth phosphors during excitation is moderately great, but by no means equal to that displayed by zinc and zinc cadmium sulphide phosphors.

The chemical stability of alkaline earth phosphors is very low. They are readily attacked even by moist air, with the evolution of sulphuretted hydrogen, and the gradual destruction of their luminescent properties.

Phosphorescent Calcium Sulphide

Phosphorescent calcium sulphide has been known for quite a long time. It was prepared and sold under the name of Balmain's Luminous Paint and, originally at all events, it was prepared by heating calcined oyster shells with sulphur. It displays a blue fluorescence and phosphorescence, the latter being visible to the sensitive eye for very many hours after exposure to light. There has been a certain demand for this material for many years past for scientific and amusement purposes. In the Great War fairly large quantities were employed for painting direction-posts, marking roads, etc. Calcium sulphide phosphor is now prepared by heating pure calcium carbonate with sulphur with the addition of a small amount of bismuth as a phosphorogen.

In the last few years strontium sulphide phosphors have been developed and the phosphorescence displayed by these preparations is very much greater than that of calcium sulphide. An intense greenish-blue phosphorescence is displayed immediately after exposure, which decays quite slowly, so that its brightness even 12 hours after exposure is sufficient for many purposes. It is brighter after 12 hours than calcium sulphide is after a very short period.

Various sources of illumination, the spectral composition of which varies considerably, can be employed for the excitation of strontium sulphide phosphors. They are not well excited by wave-lengths shorter than about 3,000A.u., and at the other end of the spectrum the limiting wave-length causing any excitation at all is about 4,500A.u. Daylight, ultraviolet light transmitted through nickel oxide glass (the so-called " black lamp "), gas discharge tubes containing carbon dioxide, and the light from gas-filled tungsten filament lamps, are all suitable sources for the excitation of the phosphorescence. (N.B.—The nickel glass is unnecessary except for visual examination of the fluorescence).

The slopes of the decay curves of the phosphorescence excited by the various types of radiation differ; but the difference is apparent rather than real, as it is not believed to be due to any actual shape of curve, but rather to the fact that the initiation of the illumination occurs on different parts of the first portion of the same curve. The decay curves of strontium sulphide phosphor excited by various sources of radiation are shown in Fig. 3. The most intense phosphorescence for a practical time of exposure is obtained by daylight excitation, as the amount of energy incident on the surface is much greater.

The following table gives the initial brightness of strontium sulphide excited by various sources of radiation :—

Source.	*Illumination.*
Daylight	1.5 e.f.c.
125-watt black lamp at 3 feet	1.0 e.f.c.
B.S.I. standard source, at 3 feet	0.1 e.f.c.
200-watt tungsten gas-filled lamp with nickel oxide glass filter at 3 feet	0.02 e.f.c.

These figures should be regarded as only relative, as the exact illumination obviously depends upon the quality of the actual specimen and also upon the thickness of coating, its mode of application, and other similar factors.

Strontium sulphide phosphors display the well-known sensitivity to mechanical stress exhibited by many artificially

produced phosphors, inasmuch as grinding considerably reduces the intensity of their luminescence. In preparing the phosphors it is therefore essential that the mode of production is such that the phosphor is produced in the form of the fine powder necessary for the incorporation in paints, plastics, etc. If the phosphor is produced in lump form, it is impossible to reduce this to powder without completely spoiling it.

The effect of infra-red radiation of various wave-lengths upon the phosphors is very interesting. If the brightly phosphorescing sulphide is exposed to infra-red radiation of very long wave-length, which sensibly increases the temperature on exposure, the energy stored in the molecule is released much more rapidly and the brightness is considerably increased, but persists for a shorter period of time. A very slight degree of warming is all that is necessary to produce this effect. If, for example, the hand is placed upon the phosphorescing surface, the warmth produced is quite sufficient to double the immediate brightness.

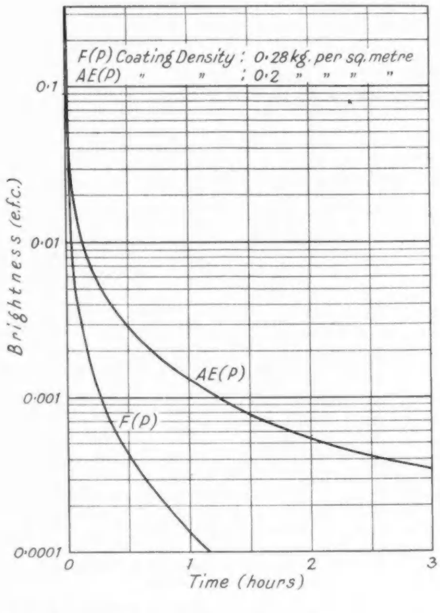


Fig. 2 (left). Decay curves for AE(P) and F(P) type powders excited by standard source described in BS/ARP/18, December, 1939.

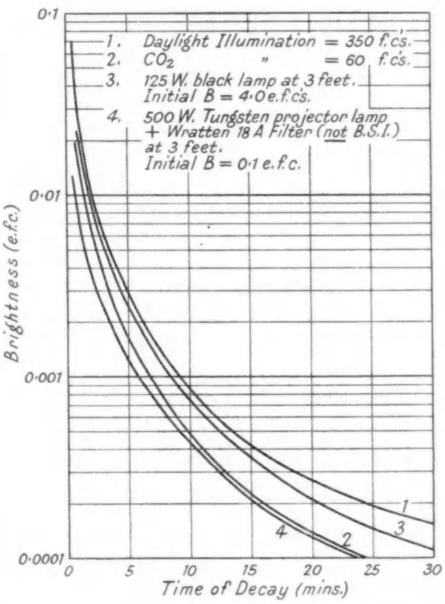


Fig. 3. (right). Decay curves for luminescent vitreous enamel F (P) activated by different sources.

The effect of infra-red radiation of short wave-length is absolutely different. In this case the phosphorescence is, as is well known, completely extinguished. The mechanism whereby this is effected is not properly understood, but is believed to be a conversion of luminous energy into vibrational energy. This effect can easily be demonstrated by fitting an electric torch with a red filter and placing the end in contact with a glowing screen for about half a minute, when it will be found that the phosphorescence on the portion illuminated by the torch is completely destroyed.

Alkaline earth phosphors show to a very marked extent the delay in the building up of the fluorescence to its maximum value. The length of time which elapses before the intensity has reached its maximum depends upon the type and intensity of the exciting source; it is about half a minute in the case of a 125-watt black lamp and may be several minutes when the exciting source is a gas-filled tungsten lamp. This delay corresponds to the first portion of the curve shown in Fig. 1.

Utilisation of Strontium Sulphide Phosphors

The high intensity of the phosphorescence and slow rate of decay exhibited by the best strontium sulphide phosphors are characteristics which enable these phosphors to be of real practical value for black-out purposes. The inherent instability of these phosphors and their liability to be attacked by moist air have militated against their successful usage. A large number of preparations have appeared on the market, in which the phosphor, whether good or bad, has been incorporated in an unsuitable medium, with the result that the useful life of the luminescent paint is very short. These difficulties have been largely overcome by the use of modern paint media and plastics, some of which are impervious to moisture and are also without chemical action upon the sulphide.

In order to obtain satisfactory results, even with paint media developed specially for use with these phosphors, it is essential that the instructions for their use be carefully carried out. The object to be coated should first be given a good coat of a white priming paint, as this increases the luminosity obtained by about 20 per cent. This primer is then coated with two layers of the plain medium, after which two coats of the luminous paint (i.e., the phosphor incorporated in the medium) are applied. Finally, two coats of the plain medium are given as a supercoat. It is also important that the edges are well sealed, so as to prevent ingress of moisture. The whole object of these instructions is to ensure that the phosphor is completely embedded in films of moisture-resisting medium. Objects painted in this manner are quite satisfactory for indoor use, but it is doubtful whether a medium completely satisfactory for outdoor use (i.e., one in which the luminosity does not fall away appreciably when the paint is exposed to all types of weather conditions) has yet been developed.

One of the most satisfactory methods of employing the phosphor, and one which is practical for many purposes, is to enclose a thin layer of the phosphor between two sheets of glass, the edges of which are carefully sealed. Alternatively it is also quite possible to coat the insides of tubes or other glass vessels with the phosphor, the vessels being subsequently sealed off. Treated in this way the phosphor is quite suitable for outdoor use.

Strontium sulphide phosphors can be incorporated only in certain types of plastics, which must, of course, be completely free from acid and should also be absolutely moisture-resisting. There are several plastics which appear to fulfil these desiderata, but sufficient time has not yet elapsed to enable it to be said definitely that the plastics are suitable when exposed out of doors. Owing to their instability it has not yet been found possible to incorporate strontium sulphide phosphors in vitreous enamels, as has been done in the case of zinc sulphide phosphors (see page 172).

In considering the efficacy of strontium sulphide materials for various purposes, due consideration should be given to

the conditions under which they are employed. If the phosphorescence be viewed during the day time, when the observer's eye is in an insensitive condition, it does not appear particularly brilliant. In fact it is necessary to rest the eye for half an hour after exposure to daylight before it has, as a general rule, reached its maximum sensitivity to feeble illumination. These phosphors are, however, required for use under black-out and other conditions in which the eye is already much more sensitive than it is in daylight. In fact if the observer has not been recently exposed to powerful artificial light, the eye is nearly in its most sensitive condition. When viewed in these circumstances the phosphorescence displayed by the strontium sulphide phosphor appears very intense and completely adequate for a number of purposes. It should be borne in mind, however, that the main use of the phosphors is to enable objects to be located by their self-luminosity, and not to afford a source of illumination whereby other objects can be perceived by the reflected light of the phosphorescence. In this connection, however, it should be noted that two square feet of surface coated with the phosphor are sufficient, when the eye is in a sensitive condition, to render the contents of a fairly large room visible for some time after the activation of the phosphor.

Compensating Decay

The intensity of the phosphorescence decays according to the curve shown in Fig. 2, but if the observer is continually in the dark the sensitivity of the eye increases somewhat, and to some extent compensates for this decay. If, for example, such an illuminated surface is kept in a bedroom and the observer should happen to wake up several hours after the phosphor has been exposed to radiation, it will be found that the amount of phosphorescence from the two square feet of surface is still sufficient to render surrounding objects visible, although not to the extent that they were during the first half hour or so.

The following are the more important A.R.P. applications for which strontium sulphide phosphors are suitable:—

(a) Interior emergency lighting for A.R.P. shelters.
(b) Exit signs and obstruction indicators for assisting in evacuation from hospitals and other buildings.
(c) The use of luminous indicators for the use of pedestrians during the black-out period.
(d) For street names and house numbers.

It should be borne in mind that strontium sulphide phosphors are not really suitable for a number of purposes, for which it has been proposed at various times that they should be employed. For example, they are unsuitable for painting kerbs and white lines on roads. Their high cost and relative instability unless they are applied with the greatest care render them unsatisfactory for these purposes. The illumination of full moonlight is about one hundred times that of the best strontium sulphide phosphor four hours after exposure to radiation. Furthermore, the phosphorescence displayed will depend upon the amount of daylight to which they have previously been exposed, and there may be many days in winter in which the illumination falling upon the phosphor is insufficient to cause it to reach anything like its maximum degree of phosphorescence.

Illuminating Keyholes

Strontium sulphide phosphors incorporated in suitable plastics should find other applications apart from those occasioned by the black-out. For example keyholes, door numbers, switch covers and the like can all be rendered obvious in the dark in this way. The persistence of the phosphorescence is quite adequate for this purpose. Attempts have been made in the past to do this by using radio-active luminous paint, but have failed owing to its high cost.

The fluorescence and the phosphorescence immediately after irradiation displayed by zinc and zinc cadmium sulphide phosphors are both much more intense than that displayed by the alkaline earth phosphors, but, as already stated, the decay curves of the intensity of the phosphorescence very soon cross. The alkaline earth phosphors give by far the more lasting phosphorescence, and were it not for their chemical instability would be preferred for every purpose. Zinc and zinc cadmium sulphides are chemically very stable, and are far more readily incorporated into paints and plastics. A considerable number of paint media can be employed, but in certain of these it will be found that the zinc sulphides, if exposed to daylight, blacken with the loss of their luminescent properties. This blackening is, however, inhibited by the use of suitable additions, and it does not occur at all when certain paint media are employed. The phosphors can be incorporated into many types of plastic material and can also be made into phosphorescent vitreous enamels.

The principal use of this type of phosphor, especially abroad, has been for use under black-out conditions in power houses, for exit signs, for the outlines of machinery, and for the dials of instruments. These are normally illuminated with black lamps, and fluoresce brilliantly. If for any reason the black lamp should be extinguished, the dials, etc., continue to phosphoresce sufficiently brightly for about half an hour afterwards.

It should be noted that in contradistinction to the alkaline earth phosphors, the colour of the phosphorescence is different from that of the fluorescence, and is nearer the red end of the spectrum. A series of zinc and zinc cadmium sulphide phosphors can be made exhibiting fluorescence of every colour. Only those displaying a green fluorescence display marked phosphorescence, though a certain degree is observable in the case of those giving yellow and orange fluorescence. The phosphorescence exhibited by the red and blue fluorescing preparations is much slighter.

The British Standards Institution have recently brought out a specification, BS/ARP/18, for the control of the quality of fluorescent and phosphorescent materials for A.R.P. The specification describes the method whereby a standard irradiation is given to the sample to be tested, and the method to be employed in the measurement of its brightness. The specification is at the present time necessarily somewhat nebulous, and though it prescribes the minimum brightness of the two types of phosphor after irradiation and also the final brightness, the period which elapses between the attainment of these two values is left to the manufacturer to specify, and this period is, of course, the actual measure of the real utility of the sample. The figures given in this specification are as follows:—

Zinc Sulphide Type Phosphors.

Minimum brightness one minute after irradiation by standard test lamp — 0.05 e.f.c.

Final brightness must not fall below 0.0001 e.f.c.

Alkaline Earth Type Phosphors.

Minimum brightness one minute after irradiation by standard test lamp — 0.02 e.f.c.

Final brightness must not fall below 0.0001 e.f.c.

We desire to express our thanks to the General Electric Company Research Laboratories for their permission to publish their measurements of the luminosities given above.

REFERENCES.

[1] Paterson, Walsh and Higgins, "An Investigation of Radium Luminous Compound" (Proc. Phys. Soc. Lond. *29*, 1917).
[2] Levy and West, "Chem. and Ind.," *58*, 19, 457.
[3] J. T. Randall, "General Discussion on Luminescence" (Trans. Faraday Soc., 1938, p. 4.)
[4] Levy and West, "General Discussion on Luminescence" (Trans. Faraday Soc., 1938, p. 128).

DETAILS OF THE LATEST DISCOVERY made at the Imperial Sugarcane Breeding Station, Coimbatore, India, of crossing cane with bamboo, which in course of time would revolutionise the sugar industry, have now been made available. The advantage of the bamboo hybrids is their resistance to water-logging, drought and disease. While they have these desirable characteristics of the bamboo they have also undesirable characteristics which the Station is engaged in eliminating.

PERSONAL NOTES

PROFESSOR F. L. WARREN, formerly of Fuad University Cairo, has been appointed Professor of Chemistry at Natal University College, Pietermaritzburg, South Africa.

* * * *

The Minister of Supply has appointed MR. W. T. V. HARMER to be Controller in respect of chrome ore, magnesite and wolfram. The offices of the Control are at Broadway Court, Broadway, Westminster, S.W.1. (Tel. Abbey 2734.)

* * * *

The following are among those recently admitted to the Fellowship of the Royal Society: LORD CADMAN, chairman Anglo-Iranian Oil Company; PROFESSOR G. COOK, Regius Professor of Civil Engineering and Mechanics, Glasgow University; MR. C. F. GOODEVE, Reader in Physical Chemistry, University College, London; PROFESSOR R. P. LINSTEAD, Professor of Organic Chemistry, Harvard University; PROFESSOR O. MAASS, MacDonald Professor of Physical Chemistry, McGill University, Montreal; MR. J. H. QUASTEL, biochemist to Cardiff Mental Hospital; PROFESSOR A. ROBERTSON, Professor of Mechanical Engineering, Bristol University; MR. W. T. ASTBURY, Reader in Textile Physics at Leeds University. Professor Cook is well known for his original investigations into the stress-strain relations of metals when passing from the elastic to the plastic state under systems of combined stresses. Mr. Astbury's chemico X-ray technique and his researches into the structure of natural fibres and proteins has opened up new fields of knowledge. Lord Cadman is Emeritus Professor of Mining and Petroleum Technology at Birmingham University. Mr. Goodeve is well known for his contributions to present-day knowledge of absorption spectra and photo-chemistry. Professor Linstead is distinguished for work in synthetic organic chemistry and Professor Maass for his researches in physical chemistry. Mr. Quastel is noted for his work on chemical reactions in resting bacteria. Professor Robertson has made fundamental contributions to knowledge relating to the stability and strength of solid and tubular struts.

LORD DUDLEY has been re-elected president of the Parliamentary and Scientific Committee for the year 1940. The other officers elected are: vice-president, Captain S. F. MARKHAM, M.P.; chairman: CAPTAIN L. F. PLUGGE, M.P.; vice-chairman, PROFESSOR B. W. HOLMAN; deputy chairman: MR. E. W. SALT, M.P. In addition to the organisations supporting the Committee, as recorded in THE CHEMICAL AGE of February 10 (page 83), the Society of Public Analysts and the Institute of Metals have also become members.

* * * *

At the annual general meeting of the Liverpool Section of the Society of Chemical Industry, MR. H. E. POTTS, of Messrs. W. P. Thompson, Ltd., was elected chairman in succession to MR. B. D. W. LUFF (Lever Bros., Ltd.), who will now fill the office of vice-chairman. The committee for the ensuing session comprises: B. P. BAXTER, G. BREARLEY, I. K. H. MCARTHUR, J. SMITH, S. J. KENNETT, W. RAMSEY SIBBALD, J. S. TOWERS, E. T. WILLIAMS, E. L. BRIGGS, W. A. M. EDWARDS, H. H. THOMAS and PROFESSOR T. P. HILDITCH. Other appointments: hon. secretary, L. J. BURRAGE; hon. recorder, G. P. GIBSON; hon. treasurer, A. E. FINDLEY. Group representatives: Chemical Engineering, PROFESSOR C. O. BANNISTER; Food Group, E. GABRIEL JONES; Plastics, B. D. W. LUFF; Road and Buildings, A. E. FINDLEY.

OBITUARY

MR. FREDERICK A. SMITH, local director for 12 years of Thomas W. Ward, Ltd., Sheffield, died on March 5 at Rio de Janeiro. Mr. Smith, who had gone to South America by air on a special Service mission, was taken ill on the voyage and died the day after his arrival.

* * * *

DR. ERIC CHARLES FLOWER BRADBROOK, of 45 Westwood Avenue, Ipswich, who was a research chemist under the I.C.I. (British Dyestuffs Corporation), died last week at the age of 28. Dr. Bradbrook's untimely death terminates the career of a brilliant scholar; he received the Ph.D. degree and the Diploma of the Imperial College at the age of 22.

Higher Pyridine Yields from Coking Plants

A considerable proportion of the pyridine bases formed during the carbonisation of coal is not retained in the tar but passes on into the crude ammonia and benzole liquors. The actual quantity of pyridine that may be lost in this way can be gathered from some figures published by Klempt and Röber (Chemische Fabrik, Feb. 24, 1940, p. 65-68). In the case of a small coking plant with an output of 280,000 cubic metres gas per day, an average of 8-12 kg. of pyridine bases per 100,000 cubic metres of gas was retained in the tar, while some 10-15 kg. appeared in the gas liquor. A process eventually devised for recovering a substantial proportion of the bases which would otherwise go to waste was based upon passing the mist from the ammonia saturator through strong sulphuric acid on its way to the benzol scrubbers. The additional yield by the sulphuric acid extraction process was reported to be at the rate of 2-3 kg. per day per 100,000 cubic metres of gas. This crude pyridine had the following average composition:—

	b.p.°C.	per cent.
Pyridine	115	69
Picoline	129	3
β-Picoline, 2,6-Lutidine	143	3.5
γ-Picoline	145	7
2,4,6-Collidine	172	0.6
Aniline	184	4
Quinoline bases	238	12

New Control Orders

Additional Import Restrictions

Under the Import of Goods (Prohibition) (No. 8) Order, 1940, the goods shown in Part 1 of the attached list have been added to the classes of goods the importation of which is prohibited except under licence issue by the Board of Trade. Amendments of wording in the Schedule to the Import of Goods (Prohibition) (Consolidation) Order, 1939, are shown in Part 2 of the list below. The Order will come into force on March 25.

[PART 1]

Blast furnace slag.

Glass tubing and rod.

Netting and other mesh of metal commonly used in filtering, screening, separating, sifting, sorting and similar operations.

Bromine and inorganic bromides.

[PART 2]

The item " Pigments, etc., other than the following " now reads as follows: " Pigments, including metallic powders, and extenders (whether dry or with oil or other medium), other than the following: Natural dyes, dry earth colours, silica, cadmium, lithopone, frits, tin oxide, vitreous enamels, luminous and radio-active powders of a kind used in the manufacture of luminous paints, graphite, carbon black from natural gas or acetylene, asbestine, talc, steatite, soapstone and French chalk."

ACTIVATING THE EXPORT DRIVE

Meeting of Manufacturers and Merchants

By
W. T. DAY, Secretary, The Institute of Export

IT is a kaleidoscopic situation, yet the issue is clear. By the publication of the Command paper on the work of the Export Council, the first objective of the Institute of Export, "to make this country export-minded" has been achieved. I am afraid, however, this belated Government effort to induce the world overseas to consume more of Britain's manufactured products may set up a little industrial indigestion. It is unfortunate, too, that this late realisation of the part which export trade plays in our national economy should so be made manifest in a time of war. It was ever thus—necessity again becomes the grand old mother of action.

To put the position rather bluntly, the Government needs a minimum of £200 millions of increased exports over the 1938 figures. From where is this to come, and how can manufacturers and merchants contribute to this colossal effort?

Importance of Specialised Industries

In a survey completed early in 1937, the Research Committee (an internal study group) of my Institute pointed out that those acting on behalf of the British Government had tended, when negotiating trade treaties, to consider, mainly if not entirely, the interests of the so-called basic or primary industries without appropriate regard to those of the secondary industries. Important as the basic industries have been and, indeed still are, they do not hold the position of importance they once held in our export trade. They are the industries that other countries have usually first sought to establish and encourage within their borders. The future of our export trade lies more with the newer and more highly specialised manufactures in which a high degree of technical skill and efficiency is required and in the production of which we have a much greater relative advantage.

The value of an industry does not depend so much upon its present size, as upon the possibility of its future expansion and the relative advantage it enjoys in the international field. There is many an industry to-day, and many more will rise in the future, that can play a valuable rôle if encouraged to develop unhampered by onerous trade restrictions.

Obviously the greater the degree of specialisation, the more diversified the products and the more numerous the industries become. Their number must inevitably make individual consultation by Government an extremely complicated task, while the relatively small proportion of the total export trade they each represent must result in the same relative weight being attached to their individual representations.

The White Paper is a human document. It quite plainly and sympathetically appreciates the above points. Now, it is for the secondary industries to put their own houses in order to simplify consultations with Government. The Prime Minister said in the House of Commons on February 1: "The people who are engaged in export trade must indicate to the Board of Trade (through the Export Council) the market to which they want to export and what is the programme they wish to carry out in a given time. They have, in fact, to stake out their claims, and they want to be assured that, having staked out their claims, they will not be upset by the intervention of some other Department which may requisition something which they thought they had secured." Later on, the same day, he said: "What we have to do is to try and provide whatever is necessary to enable us to meet the demands which are being made upon us from many quarters, and particularly from quarters which formerly did trade with Germany." As I see it, the task before the country is: (a) To expedite delivery of those goods for which orders are already on the desks of the manufacturers, and (b) to capture those world markets formerly supplied by Germany, Czechoslovakia, Austria and Poland.

Some of the secondary industries are well organised on the export front and can speak representatively, as a unit, of their requirements. On the other hand, a large number are woefully apathetic and impotent to respond effectively.

The fact that the Government has declared its intention to ration the supplies of raw materials in certain domestic industries has brought about a quickening in the tempo. In most of these industries there is a desire to "do something" of a positive character. In the process of building up our first thoughts must be given to the efficiency of the trade associations. Included in their scaffolding must be, of course, the qualified export executive, who for a long time has had had to be satisfied with the crumbs off the home market table. Where there is no hope of effectively getting the trade association to act, export groups should be formed, and it goes without saying that these too must be complete with a representative selection of qualified export men and women.

This, then, is the appropriate moment to assess our strength and survey our shortcomings and review our possibilities, so that we should have the greatest possible benefit from the opportunities as they now present themselves. Such decisions as the priority schedule in the supply of raw materials, on which in the end the extent of our export trade will largely depend, are being made by the Government, but it is safe to say that decisions on high policy can be much better influenced by merchants and manufacturers if they have a clear-cut policy and an estimate of their export horizons. The declared aim of the Government is to cause neutral traders the least possible inconvenience, and so far from blocking their trade, even to encourage them. A sign of this encouragement is the offer to them of the safety of British convoys. We may assume, therefore, that neutral traders will be able to retain their position in the world trade, even where we have a fairly complete control of raw material supplies.

Replacing German Exports

A long-term export policy will probably be the means of shortening the war. Let one thing be clear in the mind of the British business community: Germany launched this war not in 1939 but in 1933. Almost at the moment of seizing power, the Nazi Government installed a war economy which meant, according to its philosophy, that no method was too unfair and too foul if it served the strangulation of the trade of others and helped the new German god: military preparation. It is, or at least should be, of vital importance to this country that British or Allied exports should now take the place of German supplies in the world markets. Within the space available, I can only briefly review German prewar exports. These I divide into two groups: (1) those which can be and as a matter of fact are being intercepted by our contraband control, *i.e.*, overseas export; (2) those to countries adjoining Germany or easily to be reached by her without interference from the British Navy.

Germany's whole exports (excluding Great Britain, Austria, Czechoslovakia and Poland) in 1937, the last year when all the countries since seized by Germany were still independent, amounted to approximately £410,000,000. Czechoslovakia's exports (excluding Great Britain, Germany, Austria and Poland) in 1937 amounted to £62,000,000. Poland's in the same year amounted to £27,000,000 (excluding Great Britain, Czechoslovakia, Germany and Austria). Austria exported also in the same year £33,000,000 worth (excluding

Great Britain, Germany, Poland and Czechoslovakia). This gives a total of approximately £562,000,000. From that amount of German, Austrian, Czech, and Polish exports, roughly speaking, 48 per cent. went to those markets in group (2), and 52 per cent. went to group (1). These figures more than anything else show the relative magnitude of the problem.

Even if we take into account the accumulated reserves of greater Germany, this is certainly a most encouraging picture. It is a job of work demanding the complete mobilisation of our productive resources, and, as the Government has shown its preference for allowing the secondary industries to settle among themselves the planning of their own sales campaigns abroad, it is of paramount importance that numerous Export Groups should be formed in the secondary industries without delay. To this end the Institute of Export is now directing a part of its energies; not to interfere, but to co-operate in the self-determination by industries in their respective efforts to stake their claims for the equitable sharing of these former German export markets. The first positive step is the organisation of a special meeting to be held on Thursday, April 4, at 5.30 p.m., in the Palmerston Restaurant, Bishopsgate, London, when the President, Sir Patrick J. Hannon, M.P., will preside. The speaker will be Mr. W. Tudor Davies, who will review the general position and indicate the steps which should be taken by, shall we say, the lagging industries to make themselves articulate and competent to consult with Government. Not one manufacturer or merchant should miss this meeting. It ought to be held in the Albert Hall; but the authorities now lay down restrictions for the safety of the public from air-raids. The venue is bomb proof and fully licensed; but there is only accommodation for about 300. All those interested are cordially invited. Applications for tickets should be made on printed note-headings and addressed to the Secretary at the Institute office, 11 Aldwych, London, W.C.2

Recent Trade Literature

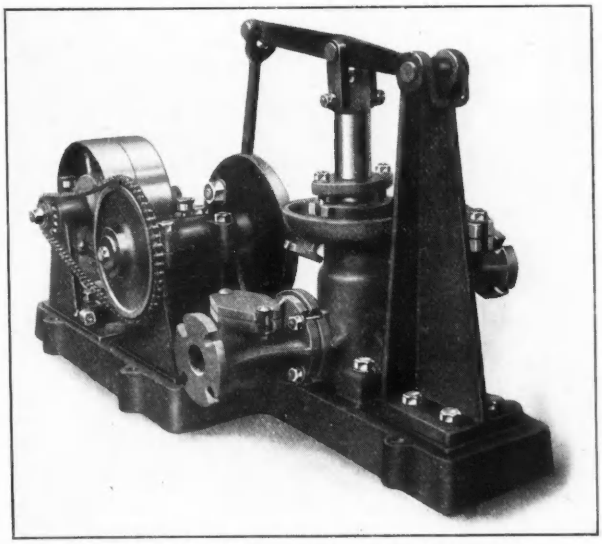
The Engineering Gazette, published by MARRYAT AND PLACE, LTD., 40 Hatton Garden, London, E.C.1, contains a number of technical articles as well as items of general interest including an article by W. Somerset Maugham.

The current issue of *The Welder*, published by MUREX WELDING PROCESSES, LTD., contains an interesting article on the use of welding for railway plate girder bridge construction by Mr. H. W. Clark, bridge and steelwork assistant of the London Passenger Transport Board. The article describes the London Transport second new all-welded bridge recently erected at Hainault, Essex. This bridge is only the second of its kind ever built in Great Britain, and although there have been a number of examples of the use of arc welding for railway bridge repairs and strengthening, the L.P.T.B. is the first authority in this country to adopt the process for the construction of new railway plate girder bridges.

A new catalogue (Section No. 4) illustrating stoneware vessels and jars for use in the chemical and allied industries has been issued recently by HATHERNWARE, LTD., Loughborough. Hathernware chemical stoneware is, it is claimed, proof against the action of all industrial acids and corrosive liquids at all concentrations and temperatures, the only exception being hydrofluoric acid. Among the products described are circular vessels which are used for many processes in the chemical and allied industries where corrosive liquids have to be handled, open jars which have large bases for stability and are usually provided with bottom outlets, closed storage jars for volatile essences, bleaching liquors, lacquers, acids, distilled water, etc., emulsion jars which provide an efficient means of storing emulsions with entire freedom from contamination, and jars for acid storage and transport.

The concentration of solutions is one of the major requirements of numerous industries, and the type of plant to suit the varied conditions which exist calls for the special attention of chemists and engineers. Most solutions vary in their chemical and physical characteristics, certain liquids on concentration solidify on cooling, others deposit salts during concentration, others have a high viscosity or boiling point; each case necessitates careful consideration to determine the most efficient and economic type of plant for the purposes required. S. BRIGGS AND CO., LTD., have designed and manufactured many types of evaporating plant and in a catalogue recently published by them they illustrate a few of the better-known types of evaporating plant they have recently manufactured. It is interesting to note that the company point out that whenever possible they prefer to co-operate with their clients' technical experts in the selection and design of the best type of plant for the specific purpose required.

MELDRUMS, LTD., engineers, Timperley, Cheshire, have issued details of new acid-resisting metal pumps. The already well-known "Meldrum" acid-resisting metal centrifugal pump has been adapted to the vertical spindle type for either wall or floor mounting. The main feature of interest is that this pump is glandless, which results in an elimination of all packing and leaky gland troubles, a refinement that will be appreciated by all users of acids. The delivery outlet may be rotated to several positions in a horizontal plane. The pump is direct coupled to a totally enclosed motor, but can be supplied for belt drive. All thrust from pump to motor is eliminated. An interesting point about this glandless type is that sealing is obtained with the liquor itself and a sufficient sealing head is maintained by a secondary reservoir incorporated in the design of the pump. The Meldrum single-acting plunger type pump (as illustrated) is arranged for belt drive. It can, however, be made as a double-acting plunger, and either belt or direct-coupled drive, or hand operation, can be fitted. The company have made improvements to their well-known horizontal centrifugal pump. It is now made with double suction inlet which, of course, puts the glands under suction only. All the pumps can be made in "Meldrum" acid-resisting metal, Regulus, Acid Bronze, or cast iron.



The Meldrum single-acting plunger type pump.

SPENDING AND SAVING

Sir Ernest Benn's Annual Survey — Stronger Position than in the Last War

SIR ERNEST BENN, the chief proprietor of THE CHEMICAL AGE, surveyed the urgent problems of war finance in his speech from the chair to the members of the United Kingdom Temperance & General Provident Institution at their annual meeting in London on March 20. He said:—

In moving the adoption of your accounts a year ago, I described my task as "perhaps more difficult than ever before in my experience." That was in a time of peace, and I suppose I ought to approach my duty to-day, in the midst of all the risks of war, with still greater diffidence. But strangely enough, that is not how I feel about it. A year ago we faced the unknown; to-day we have trials and difficulties in plenty, but in a curious sort of way, we do seem to know better where we are. We are up against grim reality, instead of mythical possibilities. The War, as war, is going far better than was thought to be possible up to last August. Our hearts are full of thankfulness as we contemplate, by the reckoning of six months ago, hundreds of thousands of empty graves, and unused hospital beds. We are devoutly grateful to a Prime Minister whose dignity of bearing and singleness of purpose have kept this grim business on a moral and intellectual level worthy of the stupendous issues at stake.

No Doubts

We are not troubled, as we sometimes were in 1914-18, with a single doubt as to the ultimate issue of the conflict. This really wonderful position has been reached by the thoroughgoing nature of our national preparations, and the determination of every individual to maintain our strength intact.

For this purpose it has been thought wise to plan and control every detail of our lives. We have willingly surrendered hard-won liberties. The middle classes, who bear most of the strain and get least of the credit, shopkeepers and professional men and women, have faced loss without a murmur, so long as they felt they were thus serving the national interest. Merchants, brokers, agents, jobbers, commercial travellers have been put out of business by controls and pools. Markets have been abolished, and the consequent damage to our economic foundations is beyond computation. Still there is no word of protest if all this is helping to win the war. Doubts and discontents do, however, creep in, when it is found that some of the control is planned and exercised by avowed enemies of private enterprise. It is open to doubt whether all of these costly schemes would have seen the light if war-winning had been the only motive in the minds of their devisers.

It is of the first importance that we should be quite clear that control and management, with all their costly blunders, while necessary for war, are devices for use by dictators who rely not upon confidence, but upon force, and that these things have no lot or part in any true conception of the peaceful democratic State. The levity with which control schemes are made, altered, withdrawn and revived only strengthens the conclusion that public affairs have a long way to go before they reach the standards of responsibility common to the City of London.

It would be idle, in these circumstances, to pretend that your vast estate is unaffected by the events of the last six months. On the other hand, it would be wrong to overestimate the extent of the damage. It seems to me that the proper comparison is not with the recent past, but with the year 1914, when the Institution faced for the first time risks and losses comparable with those of 1939. The outstanding difference is that in 1914 we were not prepared, we had no precedents. We had large investments abroad, much larger, in proportion to our funds, than we possess to-day. We had no Reserve Fund: nothing of the kind had been necessary in our previous experience. As the war progressed we had by degrees to assimilate the implications of a long and costly struggle. A very different position arose in September, 1939. The anxieties and uncertainties of recent years had prompted us to set aside a million, outside the total of our fund, to meet unforeseen contingencies—a quite unusual precaution in assurance accountancy. If we entertained any hopes, as in 1914, of a short and sharp struggle, we left those hopes out of our calculations, and accepted to the letter the Government's view of a three years' war. Whereas 25 years ago the full effects crept gradually upon us, this time we discounted them all, right at the start, with the result that we feel that if there is any safety anywhere in a time of modern war, we have rather more of it to-day than we had at the corresponding meeting 25 years ago.

Many people are puzzled by the problems of spending and saving, the small saver in particular finding the arguments difficult to apply to his own circumstances. This and similar institutions are able to provide the perfect solution. The truth can be stated in very simple terms. "First of all refrain so far as you can from the purchase of anything which involves an import from abroad, or which absorbs labour wanted by the Government for the purposes of the war. Then carry on with your normal purchases of other things to keep the trade of the country going, exercising a little more than your usual economy. If your income remains stationary, or improves, you will find yourself with a surplus, which if applied to Life Assurance will enable us to give additional support to War Loans and provide you with the best of all possible investments."

The machinery of public affairs is so arranged that trouble, hardship and grievance come to the top. We hear a great deal about the few things that go wrong and very little about the many things that go right. In this way there has been publicity given to the difficulty of paying insurance premiums and loan interest, from which the public may gather a wholly false impression. Our experience is that these difficulties are far fewer than might be expected. They divide themselves into two classes, the most vocal of which consists of that small minority of insurers who are always in difficulties and whose troubles bear little or no relation to the war. A very small residue is in real war difficulty and in all these cases the directors, feeling that they have the general body of members behind them, have done everything possible to help.

War Loan Duties

Twenty-five years ago, one of my predecessors, the late Sir Thomas Whittaker, addressed you on the duties of a Life Office towards War Loans. We were then, as now, doing all that was possible to support the Government in the prosecution of the Great War. We were faced then, as now, with competitors who felt it appropriate to use War Loans as a means to new business and were criticised for what some thought to be lack of enterprise and even lack of patriotism. Our views have not changed in this matter. We invite insurers to accept the protection of the £26,000,000 of our general fund and to share in the profits or losses arising from our investments. That we believe to be the proper basis of Mutual Life Assurance and we are not prepared to earmark any particular investment to any particular policy. We applied for our share of the recent War Loan and our allotment with all its prospects belongs in equal measure to the whole body of our members.

With this year the Institution achieves its centenary and next March, if you will still put up with me, I hope to be addressing you in far happier circumstances.

General News—From Week to Week

THE PRESENT licensing system for steel supplies, which has been found not to work perfectly in all respects, will be superseded by a new scheme of distribution coming into force on April 1.

BECAUSE OF THE INCREASED cost of living, the Chemical Workers' Union has decided to apply for a 10s. increase for men and 5s. increase for women and proportionate increases for juniors in certain groups.

THE TRADE OF THE CHEMICAL SUNDRIES factory of the Scottish Co-operative Wholesale Society for the year ended January 20, 1940, showed an increase of over 1,300 tons compared with the preceding year.

A MEETING OF THE BRITISH SECTION of the International Society of Leather Trades' Chemists was held last Saturday at the Grand Hotel, Leicester, when papers were read on "The Conductimetric Analysis of Chrome Liquors," by Mr. S. G. Shuttleworth; and on "Some Aspects of the Chemistry of Chrome Tanning," by Mr. H. C. Holland; and Jessup Cutbush showed his very interesting film on "The Manufacture of Gas Meter Diaphragms," from the live East Indian "Persian" sheep, to a series of close-ups of the skilled process of cutting diaphragms together with tests through which the finished diaphragms passed before being "hall-marked."

AT THE ANNUAL MEETING OF COURTAULDS, LTD., last week, Mr. Samuel Courtauld, the chairman, referred to British Nylon Spinners, Ltd., in which Courtaulds is associated with Imperial Chemical Industries, Ltd. He said that except for limited special purposes it was not expected that Nylon would compete with the older kinds of Rayon, as it cost more to produce, but it would find new fields of its own, as well as competing on very favourable terms with natural silk. The company was now engaged in erecting a commercial-scale plant which should get into production by the autumn. Naturally progress was very much hampered by the difficulty in getting engineering supplies.

Foreign News

THE EXPORTATION of clove oil and cloves from Zanzibar is now prohibited, except under licence.

ANOTHER NEW SYNTHETIC PRODUCT from Japan, Silkool, is a protein fibre turned out by the Showa Sangyo K.K., and differs from lanital in being made from Manchurian soya bean protein.

IT IS REPORTED that to avoid competition and the unnecessary consumption of raw materials all French soap manufacturers are to be required to manufacture the same quality of soap, which will be known as "national soap."

ILMENITE IS OBTAINED from amang, a black mineral substance found associated with tin ore in the Perak State, F.M.S. During 1938, 2,330 tons of ilmenite were exported from Perak, most of which was obtained from the dumps of dredging companies.

A NEW COMPANY, the Société Fonderie de Beaufort, has been formed in France with a nominal capital of one million francs, to undertake the smelting of magnesium, etc. The S.A. Electro-Chimie, Electro-Métallurgie et Aciéries d'Ugine is interested in the new company.

PREPARATORY WORK has been started on the new factory of the Estonian Phosphorite Co., at Maardu, about 13 km. from Tallinn (see THE CHEMICAL AGE, *41*, 1070, 449). The plant will be ready in December and is calculated to turn out anything from 120,000 to 130,000 tons of concentrated phosphate annually.

THE EXPLOITATION OF THE KAOLIN DEPOSITS at Serrenti, Sardinia, is now being actively pursued, as part of the general Italian drive towards autarky. Though located as long ago as 1875, the Sardinian kaolins were first utilised in 1914-18, but since then the production had fallen off greatly. Considering the large extent of the deposit, the Sardinian kaolins are remarkably constant in their properties; the typical composition is as follows: Silica 52.55-57.89, alumina 27.51-33.24, iron oxide 1.08-2.23, lime 0.25-0.42, magnesia 0.17-0.25, potash and soda 0.60-1.40 per cent. The comparatively high proportion of Fe_2O_3 in some samples leads to the discoloration of the burned clay and the principal use of the kaolin is therefore in the manufacture of refractories.

EXPORTS OF ACETONE from the United States doubled themselves in 1939 to 23,115,332 lb. from 11,212,013 lb. in 1938. The trend of exports has been upward since 1935.

AT A RECENT MEETING of the Technological Research Sub-Committee of the Indian Central Cotton Committee, the proposal for the manufacture of chemical cotton by putting up a pilot plant was considered. A quotation for the full investigation of the proposal has been received from Messrs. Lockwood Green, U.S.A., for £500. The Committee decided to proceed with the investigation.

IMPORTS OF NON-FERROUS METALS into Denmark in 1939 totalled 44,433 tons, valued at 41,861,000 kroner, compared with 32,135 tons, valued at 30,488,000 kroner, in 1938. Exports of non-ferrous metals were practically stationary at 9,272 tons (1939), as against 9,274 tons (1938). The total value of all chemicals imported was 44,584,000 kroner, against 34,172,000 kroner in 1938, while exports of chemicals in 1939 were valued at 15,173,000 kroner, against 11,866,000 kroner in 1938.

AS A RESULT OF THE 1931 REPORT of the Drug Inquiry Committee, headed by Col. R. N. Chopra, on the magnitude of the evil of unwholesome and inferior drugs and medicines on sale in India, the Government of India has at length decided to introduce a comprehensive measure for control of drug manufacture, import, export and sale in all its stages. In exercising that control and supervision the Government will be assisted by a Drugs Technical Advisory Board and a Central Drugs Laboratory, both to be set up in the near future.

IMPORTS OF CHEMICALS INTO NORWAY in 1939 amounted to 30,161,000 kroner, against 21,611,000 kroner in 1938, the principal items being chlorine, sulphuric acid, caustic soda, sodium carbonate, Glauber's salt, caustic potash, bleaching powder, calcium chloride, potassium carbonate, aluminium sulphate and alum. Exports of chemicals were valued at 20,434,000 kroner (1939), against 16,036,000 kroner (1938), and included 65,796 tons of calcium carbide. Imports of non-ferrous metals into Norway in 1939 were valued at 45,900,000 kroner against 36,100,000 kroner in 1938, while exports under this head were valued at 94,990,000 kroner against 97,000,000 kroner.

THE DANISH OUTPUT OF CRUDE COAL TAR has been increasing from year to year since 1934 and in 1938 reached 32,985 tons, the largest figure yet registered. Coal tar obtained from the municipal gas works in Denmark is collected and treated by the Danske Gasvaerkers Tjaerekompagni, whose plants are at Nyborg. With road work causing an increasing use of asphalt, imports of which rose from a total of 33,583 tons in 1938 to 39,785 during the last 9 months of 1939, domestic supplies of tar have exceeded consumption, and the disposal of this by-product has become somewhat of a problem. In 1938 exports of crude coal tar amounted to 9,027 tons compared with only 2,272 in 1937; during the first 8 months of 1939 exports were 3,779 tons.

Forthcoming Events

THE ANNUAL GENERAL MEETING of the Bristol Section of the Society of Chemical Industry will be held on March 28 at 6.45 p.m. in the Chemical Department, Bristol University (Woodland Road).

A JOINT MEETING of the Chemical Society, Institute of Chemistry, and Society of Chemical Industry (Bristol and South-Western Counties Sections) will be held on March 28 in the University Chemical Department (Woodland Road), Bristol, after the annual general meetings of the various sections. At 7 p.m. a paper on "Dangers in Chemical Works," will be presented by Mr. S. H. Wilkes, M.A., B.Sc. (H.M. Engineering Inspector of Factories).

THE EIGHTEENTH ANNUAL CORPORATE MEETING of the Institution of Chemical Engineers will be held at 11 a.m. on April 5 at the Hotel Victoria, Northumberland Avenue, London, W.C.2. This will be followed at 11.15 by an Extraordinary Corporate Meeting and at 11.45 by an address on "Oil," given by the President, Mr. F. Heron Rogers. The proceedings will conclude with a luncheon (12.45 for 1 p.m.) at which the principal speaker will be Mr. Leslie Burgin, Minister of Supply.

Weekly Prices of British Chemical Products

A FAIRLY substantial demand for general chemicals is reported this week and market activity is certainly more pronounced than is usual for the period. Traders report a good volume of export orders and with the end of the quarter not far away short term contract bookings are again receiving attention. The tone remains very firm and there are no important price movements to record. There are no special features in the market for coal tar products, trade being of a routine nature with contract deliveries continuing on a regular basis. Carbolic acid crystals and naphthalene are in good request and firm in quotation.

MANCHESTER.—Partly because of the approaching holidays and partly also because a good many users are already fairly well booked business in chemicals on the Manchester market during the past week has been on rather quieter lines so far as fresh bookings are concerned, though apart from seasonal influences there has been a continued call for deliveries against contracts, particularly in the textile and allied trades. The alkalis generally are fairly active sections, and spot offers of the potash compounds are being readily taken up at a high range of prices in most instances. With regard to the by-products values are very firm and the light materials are in good demand.

GLASGOW.—The demand for heavy chemicals continues to be active and prices have been steady at fairly high levels for some time. There is a seasonal demand for all fertiliser chemicals and substantial inquiries have been received from rubber proofing and textile industries. Export inquiries are increasing. Higher prices are observed in textile malt, whiting and potassium ferrocyanide. New shipments of starch and glucose have made conditions in these markets very active during the past week.

Price Changes

Rises: Carbon Bisulphide, Carbon Tetrachloride, Chromic Oxide.

* In the case of certain products, here marked with an asterisk, the market is nominal, and the best ascertainable prices have been scheduled. At present all intermediates are included under this head.

General Chemicals

Acetic Acid.—Maximum prices per ton: 80% technical, 1 ton £34 15s.; 10 cwt./1 ton, £35 15s.; 4/10 cwt., £36 15s.; 80% pure, 1 ton, £36 15s.; 10 cwt./1 ton, £37 15s.; 4/10 cwt., £38 15s.; commercial glacial, 1 ton, £44; 10 cwt./1 ton, £45; 4/10 cwt., £46; delivered buyers' premises in returnable barrels. £4 per ton extra if packed and delivered in glass.

Acetone.—Maximum prices per ton. 50 tons and over, £49 10s.; 10/50 tons, £50; 5/10 tons, £50 10s.; 1/5 tons, £51; single drums, £52, delivered buyers' premises in returnable drums or other containers having a capacity of not less than 45 gallons each; delivered in containers of less than 45 gallons but not less than 10 gallons £10 10s. per ton in excess of maximum prices; delivered in containers less than 10 gallons each £10 10s. per ton in excess of maximum prices, plus a reasonable allowance.

***Alum.**—Loose lump, £8 7s. 6d. per ton d/d.

***Aluminium Sulphate.**—About £8 per ton f.o.b. Liverpool.

Ammonia Anhydrous.—99.95%, 1s. to 2s. per lb., according to quantity in loaned cylinders, carriage paid; less for important contracts.

Ammonium Carbonate.—£32-£36 per ton d/d in 5 cwt. casks.

Ammonium Chloride.—Grey galvanising, £18 per ton, in casks, ex wharf. See also Salammoniac.

***Antimony Oxide.**—£68 per ton.

Arsenic.—99/100%, about £25 per ton, ex store.

Barium Chloride—98/100%, prime white crystals, £11 10s. 0d. to £13 per ton, bag packing, ex works; imported material would be dearer.

Bleaching Powder.—Spot, 35/37% £10 per ton in casks, special terms for contract.

Borax, Commercial.—Granulated, £20 10s. per ton; crystal, £21 10s.; powdered, £22; extra finely powdered, £23; B.P. crystals, £29 10s.; powdered, £30; extra fine £31 per ton for ton lots in free 1-cwt. bags, carriage paid in Great Britain. Borax Glass, lump, £64; powder, £65; in tin-lined cases for home trade only, packages free, carriage paid in Great Britain.

Boric Acid.—Commercial granulated, £34 10s. per ton; crystal £35 10s.; powdered, £36 10s.; extra finely powdered, £38 10s.; large flakes, £47; B.P. crystals, £43 10s.; powdered, £44 10s.; extra fine powdered, £46 10s. per ton for ton lots, in free 1-cwt. bags, carriage paid in Great Britain.

Calcium Bisulphite.—£7 10s. per ton f.o.r. London.

***Calcium Chloride.**—GLASGOW: 70/75% solid, £5 12s. 6d. per ton ex store.

Charcoal Lump.—£10 to £12 per ton, ex wharf. Granulated £11 to £14 per ton according to grade and locality.

***Chlorine, Liquid.**—£19 15s. per ton, d/d in 16/17 cwt. drums (3-drum lots); 4¾d. per lb. d/d station in single 70-lb. cylinders.

Chrometan.—Crystals, 4d. per lb.; liquor, £19 10s. per ton d/d station in drums. GLASGOW: Crystals 4d. per lb. in original barrels.

Chromic Acid.—1s. per lb., less 2½%; d/d U.K. GLASGOW: 1s. 0½d. per lb. for 1 cwt. lots.

Chromic Oxide.—Green, 1s. 4d. per lb., d/d U.K.

Citric Acid.—1s. 2d. per lb. MANCHESTER: 1s. 3d.

***Copper Sulpate.**—Nominal.

Cream of Tartar.—100%, £6 2s. to £6 7s. per cwt., less 2½%. Makers' prices nominal, imported material about £170 per ton to quantity, d/d in sellers' returnable casks; imported material would be dearer.

Formic Acid.—85%, £44 10s. per ton for ton lots, carriage paid, carboys returnable; smaller parcels quoted at 46s. 6d. to 49s. 6d. per cwt., ex store.

Glycerine.—Chemically pure, double distilled, 1,260 s.g., in tins, £3 10s. to £4 10s. per cwt. according to quantity; in drums, £3 2s. 6d. to £3 16s. 0d. Refined pale straw industrial, 5s. per cwt. less than chemically pure.

Hexamine.—Technical grade for commercial purposes, 1s. 4d. per lb.; free-running crystals are quoted at 1s. 7½d. to 1s. 10½d. per lb.; carriage paid for bulk lots.

Hydrochloric Acid.—Spot, 6s. 1½d. to 8s. 7½d. carboy d/d according to purity, strength and locality.

Iodine.—Resublimed B.P., 9s. 2d. to 13s. per lb., according to quantity.

Lactic Acid.—(Not less than ton lots). Dark tech., 50% by vol., £30 10s. per ton; 50% by weight, £35; 80% by weight, £60; pale tech., 50% by vol., £36; 50% by weight, £42; 80% by weight, £67. One ton lots ex works; barrels returnable.

Lead Acetate.—White, £48 to £50, ton lots.

Lead Nitrate.—About £44 per ton d/d in casks.

Lead, Red.—English, 5/10 cwt., £41 10s.; 10 cwt. to 1 ton, £41 5s.; 1/2 tons, £41; 2/5 tons, £40 10s.; 5/20 tons, £40; 20/100 tons, £39 10s.; over 100 tons, £39 per ton, less 2½ per cent., carriage paid; non-setting red lead, 10s. per ton dearer in each case; Continental material, £1 per ton cheaper.

Lead, White.—Dry English, less than 5 tons, £51; 5/15 tons, £47; 15/25 tons, £46 10s.; 25/50 tons, £46; 50/200 tons, £45 10s. per ton, less 5% carriage paid; Continental material, £1 per ton cheaper. Ground in oil, English, 1/5 cwt., £59 10s. 5/10 cwt., £58 10s.; 10 cwt. to 1 ton, £58; 1/2 tons, £56 10s.; 2/5 tons, £55 10s.; 5/10 tons, £53 10s.; 10/15 tons, £52 10s.; 15/25 tons, £52; 25/50 tons, £51 10s.; 50/100 tons, £51 per ton, less 5% carriage paid. Continental material £2 per ton cheaper.

Litharge.—1 to 2 tons, £41 per ton.

Magnesite.—Calcined, in bags, ex works, about £12 to £15 per ton.

Magnesium Chloride.—Solid (ex wharf), £12 per ton.

***Magnesium Sulphate.**—Commercial, £5 10s. per ton, ex wharf.

Mercury Products.—Controlled prices for 1 cwt. quantities: Bichloride powder, 9s. 1d.; bichloride lump, 9s. 8d.; bichloride ammon. powder, 10s. 7d.; bichloride ammon. lump, 10s. 5d.; mercurous chloride, 10s. 11d.; mercury oxide, red cryst., B.P., 12s. 3d.; red levig. B.P., 11s. 9d.; yellow levig. B.P., 11s. 7d.

***Methylated Spirit.**—61 O.P. industrial, 1s. 5d. to 2s. per gal.; pyridinised industrial, 1s. 7d. to 2s. 2d.; mineralised, 2s. 6d. to 3s. Spirit 64 O.P. is 1d. more in all cases and the range of prices is according to quantities.

***Nitric acid.**—Spot, £19 to £26 per ton, according to strength, quantity and destination.

Oxalic Acid.—From £60 per ton for ton lots, carriage paid, in 5-cwt. casks; smaller parcels would be dearer; deliveries slow.

***Paraffin Wax.**—Nominal.

Potash, Caustic.—Liquid, £30 to £35 per ton, according to quantity.

Potassium Bichromate.—5⅝d. per lb. carriage paid. GLASGOW: 5⅝d. per lb., carriage paid.

Potassium Chlorate.—Imported powder and crystals, ex store London, 10d. to 1s. per lb.

Potassium Iodide.—B.P., 8s. to 11s. 2d. per lb., according to quantity.

Potassium Nitrate.—Small granular crystals, £26 to £29 per ton ex store, according to quantity.

Potassium Permanganate.—B.P., 1s. 4½d. to 1s. 5½d. per lb.; commercial, £7 9s. 6d. to £8 1s. 6d. per cwt., according to quantity, d/d.

Potassium Prussiate.—Yellow, about 1s. 2d. to 1s. 5d. per lb., supplies scarce.

Salammoniac.—Dog-tooth crystals, £45 per ton; medium, £43 10s.; fine white crystals, £16 10s.; in casks, ex store.
Soda Ash.—Light 98/100%, £6 2s. 6d. per ton f.o.r. in bags.
Soda, Caustic.—Solid, 76/77% spot, £14 per ton d/d station.
Soda Crystals.—Spot, £5 to £5 5s. per ton d/d station or ex depot in 2-cwt. bags.
Sodium Acetate.—£37 to £40 per ton, ex wharf.
Sodium Bicarbonate.—About £10 10s. to £11 10s. per ton, in bags.
Sodium Bichromate.—Crystals, 4¾d. per lb., net d/d U.K. with rebates for contracts. GLASGOW: 5¾d. per lb., carriage paid.
Sodium Bisulphite Powder.—60/62%, £16 per ton d/d in 2-ton lots for home trade.
Sodium Carbonate Monohydrate.—£20 per ton d/d in minimum ton lots in 2 cwt. free bags.
Sodium Chlorate.—£32 to £39 per ton, d/d, according to quantity.
Sodium Hyposulphite.—Pea crystals, £16 17s. 6d. per ton for 2-ton lots; commercial, £13 10s. per ton. MANCHESTER: Commercial, £13; photographic, £16 10s.
Sodium Iodide.—B.P., for not less than 28 lb., 8s. 10d. per lb.; for not less than 7 lb., 10s. 9d. per lb.
***Sodium Metasilicate.**—£14 5s. per ton, d/d U.K. in cwt. bags.
Sodium Nitrate.—Refined, £9 10s. to £10 per ton for 6-ton lots d/d.
Sodium Nitrite.—£18 15s. per ton for ton lots.
Sodium Perborate.—10%, £4 10s. per cwt. d/d in 1-cwt. drums.
Sodium Phosphate.—Di-sodium, £16 to £17 per ton delivered for ton lots. Tri-sodium, £18 per ton delivered per ton lots.
Sodium Prussiate.—From 6d. per lb. ex store.
Sodium Silicate.—£8 2s. 6d. per ton, for 4-ton lots.
***Sodium Sulphate (Glauber Salts).**—£4 10s. per ton d/d.
Sodium Sulphate (Salt Cake).—Unground spot, £4 1s. per ton d/d station in bulk. MANCHESTER: £4.
Sodium Sulphate.—Solid 60/62%, Spot, £13 15s. per ton d/d in drums; crystals, 30/32%, £9 10s. per ton d/d in casks. MANCHESTER: Concentrated solid, 60/62%, £13; crystals, £9 15s.
***Sodium Sulphite.**—Pea crystals, spot, £16 per ton d/d station in kegs.
***Sulphur Precip.**—B.P., £55 to £60 per ton according to quantity. Commercial, £50 to £55.
Sulphuric Acid.—168° Tw., £5 7s. to £5 17s. per ton; 140° Tw. arsenic-free, £3 15s. to £4 5s.; 140° Tw., arsenious, £3 7s. 6d.
Tartaric Acid.—1s. 6½d. per lb., less 5%, carriage paid for lots of 5 cwt. and upwards. Makers' prices nominal; imported material 2s. 3d. to 2s. 6d. per lb., ex wharf. MANCHESTER: 1s. 7d. per lb.
Zinc Oxide.—Maximum prices: White seal, £30 17s. 6d. per ton; red seal, £28 7s. 6d. d/d; green seal, £29 17s. 6d. d/d buyers' premises.
Zinc Sulphate.—Tech., about £25, carriage paid, casks free.

Rubber Chemicals

Antimony Sulphide.—Golden, 9¾d. to 1s. 6¼d. per lb., according to quality. Crimson, 1s. 8d. to 1s. 11d. per lb.
Arsenic Sulphide.—Yellow, 1s. 6d. to 1s. 8d. per lb.
Barytes.—Imported material £6 to £9 per ton according to quality.
Carbon Black.—About 7d. to 7¼d. per lb., according to quantity.
Carbon Bisulphide.—£31 to £36 per ton, according to quantity, in free returnable drums.
Carbon Tetrachloride.—£50 to £55 per ton, according to quantity, drums extra.
India-rubber Substitutes.—White, 5¾d. to 6¾d. per lb.; dark 5¼d. to 6d. per lb.
Lamp Black.—Imported material is quoted at about £35 to £40 per ton.
Lithopone.—30%, £18 17s. 6d. per ton; 60%, £31 to £32 per ton. Imported material would be dearer.
Sulphur.—Finely powdered, about £15 per ton, delivered.
Sulphur Chloride.—6d. to 8d. per lb., according to quantity.
Vegetable Black.—£35 per ton upwards; 28/30%, £15 10s. 0d.; 60%, £29, delivered buyers' premises.
Vermilion.—Pale or deep, 8s. 5d. per lb., for 7 lb. lots.
Zinc Sulphide.—About £63 per ton ex works.

Plus 5% War Charge.

Nitrogen Fertilisers

Ammonium Sulphate.—Per ton in 6-ton lots d/d farmer's nearest station, March/June, £9 6s.
Calcium Cyanamide.—£12 10s. for 5-ton lots per ton net f.o.r. or ex store, London. Supplies small.
"**Nitro-Chalk.**"—£8 18s. per ton, in 6-ton lots, d/d farmer's nearest station, January/June delivery.
Concentrated Complete Fertilisers.—£11 18s. to £12 4s. per ton in 6-ton lots, d/d farmer's nearest station.
Ammonium Phosphate Fertilisers.—£11 14s. to £16 6s. per ton in 6-ton lots, d/d farmer's nearest station.

Coal Tar Products

Benzol.—Industrial (containing less than 2% of toluol), 2s. to 2s. 1d. per gal., ex works, nominal.
Carbolic Acid.—Crystals, 1s. 1d. per lb.; Crude, 60's, 3s. 7d. to 3s. 9d., acording to specification. MANCHESTER: Crystals, 1s. 3d. per lb., d/d; crude, 4s. to 4s. 3d. naked, at works.
Creosote.—Home trade, 5d. per gal., f.o.r., makers' works; exports 6d. to 6¼d. per gal., according to grade. MANCHESTER: 4¾d. to 7d.
Cresylic Acid.—99/100%, 2s. 11d. to 3s. 3d. per gal., according to specification. MANCHESTER: Pale, 99/100%, 3s.
Naphtha.—Solvent, 90/100°, 1s. 8d. to 1s. 9d. per gal.; solvent, 95/160°, 1s. 11d. to 2s., naked at works; heavy 90/190°, 1s. 3d. to 1s. 5d. per gal., naked at works, according to quantity. MANCHESTER: 90/160°, 1s. 9d. to 1s. 11d. per gal.
Naphthalene.—Crude, whizzed or hot pressed, £10 to £11 per ton; purified crystals, £20 per ton in 2-cwt. bags; flaked, £21 5s. per ton. Fire lighter quality, £6 to £7 per ton ex works. MANCHESTER: Refined, £25.
Pitch.—Medium, soft, 40s. per ton, f.o.b. MANCHESTER: 37s. 6d., f.o.b. East Coast.
Pyridine.—90/140°, 19s. to 25s. per gal.; 90/160°, 16s. to 19s. 6d. 80/180°, 3s. 9d. to 4s. 6d. per gal., f.o.b. MANCHESTER: 18s. to 21s. per gal.
Toluol.—90%, 2s. 3d. per gal.; pure, 2s. 5d., nominal. MANCHESTER: Pure, 2s. 5d. per gal., naked.
Xylol.—Commercial, 2s. 9d. per gal.; pure, 2s. 11d. MANCHESTER: 2s. 11d. per gal.

Wood Distillation Products

Calcium Acetate.—Brown, £8 to £8 10s. per ton; grey, £12 to £13. MANCHESTER: Grey, £14.
Methyl Acetone.—40.50%, £42 per ton.
Wood Creosote.—Unrefined, 1s. to 1s. 3d. per gal., according to boiling range.
Wood Naphtha, Miscible.—3s. 7d. to 4s. per gal.; solvent, 4s. to 4s. 6d. per gal.
Wood Tar.—£5 to £6 per ton, according to quality.

*Intermediates and Dyes

Aniline Oil.—Spot, 8d. per lb., drums extra, d/d buyer's works.
Aniline Salts.—Spot, 8d. per lb., d/d buyer's works, casks free.
Benzaldehyde.—1s. 10d. per lb., for cwt. lots, net packages.
Benzidine, HCl.—2s. 7d. per lb., 100% as base, in casks.
Benzoic Acid, 1914 B.P. (ex toluol).—1s. 11d. per lb., d/d buyer's works.
m-**Cresol** 98/100%.—1s. 8d. to 1s. 9d. per lb. in ton lots.
o-**Cresol** 30/31° C.—8d. to 9d. per lb. in ton lots.
p-**Cresol** 34/35° C.—1s. 8d. to 1s. 9d. per lb. in ton lots.
Dichloraniline.—2s. 1½d. to 2s. 7d. per lb.
Dimethylaniline.—Spot, 1s 7½d. per lb., package extra.
Dinitrobenzene.—8d. per lb.
Dinitrochlorbenzene, Solid.—£79 5s. per ton.
Dinitrotoluene.—48/50° C., 9d. per lb.; 66/68° C., 11½d.
Diphenylamine.—Spot, 2s. 3d. per lb.· d/d buyer's works.
Gamma Acid.—Spot, 4s. 4½d. per lb. 100%, d/d buyer's works.
H Acid.—Spot, 2s. 7d. per lb.; 100%, d/d buyer's works.
Naphthionic Acid.—1s. 10d. per lb.
β-**Naphthol.**—£97 per ton; flake, £94 8s. per ton.
α-**Naphthylamine.**—Lumps, 1s. 1d. per lb.
β-**Naphthylamine.**—Spot, 3s. per lb.; d/d buyer's works.
Neville and Winther's Acid.—Spot, 3s. 3½d. per lb. 100%.
o-**Nitraniline.**—4s. 3½d. per lb.
m-**Nitraniline.**—Spot, 2s. 10d. per lb. d/d buyer's works.
p-**Nitraniline.**—Spot, 1s. 10d. to 2s. per lb., in 90-gal. drums.
Nitrobenzene.—Spot, 4½d. to 5½d. per lb., in 90-gal. drums, drums extra, 1-ton lots d/d buyer's works.
Nitronaphthalene.—10d. per lb.; P.G., 1s. 0½d. per lb.
Sodium Naphthionate.—Spot, 1s. 11d. per lb. 100%, d/d buyer's works.
Sulphanilic Acid.—Spot, 8¾d. per lb. 100%, d/d buyer's works.
o-**Toluidine.**—11d. per lb., in 8/10 cwt. drums, drums extra.
p-**Toluidine.**—2s. per lb., in casks.
m-**Xylidine Acetate.**—4s. 5d. per lb., 100%.

Latest Oil Prices

LONDON.—March 21.—For the period ending March 30, per ton, net, naked, ex mill, works or refinery, and subject to additional charges according to package and location of supplies:—LINSEED OIL, raw, £42 10s. RAPESEED OIL, crude, £44 5s. COTTONSEED OIL, crude, £31 2s. 6d.; washed, £34 5s.; refined edible, £35 12s. 6d.; refined deodorised, £36 10s. SOYA BEAN OIL, crude, £33; refined deodorised, £37. COCONUT OIL, crude, £28 2s. 6d.; refined deodorised, £31 7s. 6d. PALM KERNEL OIL, crude, £27 10s.; refined deodorised, £30 15s. PALM OIL, refined deodorised, £33. GROUNDNUT OIL, crude, £35 10s.; refined deodorised, £40. WHALE OIL, crude hardened, 42 deg., £30 10s.; refined hardened, 42 deg., £33. ACID OILS.—Groundnut, £24; soya, £22; coconut and palm kernel, £22 10s. ROSIN, 25s. to 35s. per cwt., ex wharf, according to grade. TURPENTINE, 54s. 9d. per cwt., spot, American including tax, ex wharf, barrels, and ex discount.

HULL.—March 20.—American turpentine, spot, 56s. per cwt. in barrels ex store.

New Companies Registered

R. Lord and Sons, Ltd. (359,852).—Private company. Capital £7,000 in 7,000 shares of £1 each. To carry on business as makers, manufacturers and repairers of and dealers in boilers, digesters, kiers, steam chests, heaters, vulcanising and impregnating pans, cavity pans, riveted and welded chemical plant; textile, mechanical and general engineers, chemical engineers, etc. Permanent directors: Wm. Lord, 237 Walmersley Road, Bury, and Robert Lord. Solicitors: Fredk. Howarth Son and Maitland, Silver Street, Bury.

Anti-Mistant, Ltd. (359,633).—Private company. Capital £10,000 in 6,000 5 per cent. redeemable cumulative preference shares of £1 each and 80,000 ordinary shares of 1s. each. To acquire patents, secret processes, concessions, inventions, rights and privileges; to manufacture and deal in chemicals, paints, varnishes, etc. Subscribers: William A. Woodhouse, 81 Roseberry Road, Muswell Hill, N.10; Alice M. Barron. Solicitors: W. J. Woodhouse & Co., Aldwych House, W.C.2.

Bisset Agencies, Ltd. (359,581).—Private company. Capital £100 in 100 ordinary shares of £1 each. To carry on the business of British manufacturers agents in Great Britain, British Dominions, Crown Colonies and Mandated Territories, and foreign countries, manufacturers, producers, distillers and importers of and dealers in oils, lubricants, greases, tallow, petrol, paraffin, benzol, motor spirits, tar, bitumen, petroleum, wax, beeswax, fats, turpentine, rosin, paints, colours, varnishes, oil fuels etc. Directors: G. W. Leslie Allan, The Ferns, Mitcheldean, Glos., and K. Leslie Allan.

Ajax Chemical Company, Ltd. (359,193).—Private company. Capital: £1,000 in 1,000 shares of £1 each. To carry on the business of manufacturers of glass splinter-proofing materials, manufacturers of and dealers in chemicals and chemical products, china, porcelain and insulating materials and celluloid and cellulose, manufacturers of electrical equipment, manufacturers of and dealers in synthetic and plastic materials, bakelite, rubber, etc. Subscribers: Boriss Kramers and William H. Willcocks. First directors: Charles D. Depinna, David Gilbert, John L. Farmer and Boriss Kramers. Solicitors: Oscar Mason & Co., Cliffords Inn, E.C.4. Registered office: Cliffords Inn, Fleet Street, E.C.4.

Chesebrough Manufacturing Company, Ltd. (359,698).—Private company. Capital, £1,000 in 1,000 shares of £1 each. To acquire from the Chesebrough Manufacturing Co. Consolidated (a company incorporated in New York), the business hitherto carried on by them in the United Kingdom of Great Britain and Northern Ireland, and to carry on the business of manufacturers, producers, distillers, refiners, purifiers, importers, exporters, buyers, sellers and distributors of and dealers in petroleum jelly, petroleum and petroleum by-products of all kinds; pharmaceutical, consulting, analytical, manufacturing and general chemists and druggists, etc. Subscribers: Charles Plummer, Fdk. A. S. Gwatkin, Chesebrough Mfg. Co. Consolidated, of New York, U.S.A. (by Chas. Plummer). The first directors are to be appointed by the subscribers. Solicitors: McKenna & Co., 31/4 Basinghall Street, E.C.2. Registered office: Victoria Road, Willesden.

Lumex Chemical Products, Ltd. (359,896).—Private company. Capital £1,000 in £1 shares. To carry on the business of merchants and brokers, importers, exporters, manufacturers, producers, refiners, distillers, storers and distributors of and dealers in chemical products, rosin, wax, turpentine oils, etc. Subscribers: A. C. W. Wood, L. A. Strange. Secretary: L. A. Strange. Registered office: 5 Water Lane, Great Tower Street, E.C.3.

Thompson-Jaray, Ltd. (359,743).—Private company. Nominal capital £3,000. To acquire any invention relating to the lining of vessels with "GaShell," and the preparation and manufacture thereof, etc. W. J. Thompson, Harboro' Hall, Blakedown, near Kidderminster (chairman); S. J. Thompson, F. F. Jaray, A. A. Arnold, and W. Thompson (directors). W. J. and S. J. Thompson shall be permanent directors so long as John Thompson Engineering Company, Ltd., hold 25 per cent. of the paid-up capital.

Company News

British Luminescent Powder Laboratories, Ltd., Room 20 (Fourth Floor), Broad Street House, E.C.2, have changed their name to Lumens, Ltd.

Cooper, McDougall and Robertson, Ltd., manufacturers of sheep and cattle dip, have declared a dividend of 5 per cent., less tax, for the year ended September 30, 1939.

The British Oil and Cake Mills, Ltd., report an increase in profits during 1939 from £728,349 to £735,063. The ordinary dividend, however, is unchanged at 9 per cent. by the payment of a final of 5 per cent.

The British Aluminium Co., Ltd., have declared a final ordinary dividend of 8½ per cent., making 12½ per cent., for the third successive year. After income-tax, N.D.C. and E.P.T., and meeting the debenture service, the profit amounted to £697,546, compared with £657,670 in the previous year.

Commercial Intelligence

The following are taken from printed reports, but we cannot be responsible for errors that may occur.

Satisfactions

ADAM HILGER, LTD., London, E.C., optical, etc., instrument makers. (M.S., 23/3/40.) Satisfaction March 11, of debentures registered May 25, 1932.

Companies Winding-Up

CARBA DRY ICE (ENGLAND), LTD. (C.W.U., 23/3/40.) Meetings of members and creditors at 8 Staple Inn, London, W.C.1, on Thursday, April 18, 1940, at 3.15 and 3.30 p.m.

Chemical and Allied Stocks and Shares

EASTER holiday influences, and a tendency to await the next turn of events in international politics, have made for reduced business in the industrial and other departments of the Stock Exchange. There was a fairly general trend to rather lower prices, but little selling of good class securities was reported, and later the undertone of markets became a good deal firmer. The decision to reintroduce official minimum prices for British Government securities and trustee stocks created a good impression, as this is regarded as an important check to higher interest rates during the period of the war. Moreover, it prevents the possibility of any marked fall in prices in the event of unfavourable war or international news.

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As was to be expected, shares of chemical and allied companies have moved fairly closely with the prevailing market trend, and where changed, are slightly lower on balance for the week. Fison Packard held their recent rise to 40s. and B. Laporte were good with business recorded up to 71s. 3d. Greeff-Chemicals Holdings 5s. units transferred around 6s., and elsewhere Sanitas Trust preference shares changed hands at the better level of 25s. United Premier Oil and Cake were fairly active on market hopes of a small increase in the forthcoming dividend, but the price was slightly lower at 9s. 9d. Following deduction of the dividend, British Oil and Cake Mills preferred were a few pence down at 41s. 6d. Lever and Unilever were fairly well maintained at 32s. 1½d. awaiting the impending dividend announcement.

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Elsewhere there was some profit-taking in Barry and Staines after their rise in recent weeks, but Michael Nairn made a higher price. Imperial Chemical, in common with most widely-held securities, reflected the general trend to reduced prices this week, and at 31s. 3d. were 1s. 3d. down on balance, although the market remains very hopeful that the impending results will create a favourable impression. British Oxygen were lower on balance, as were Turner and Newall, Murex and British Aluminium. Results of the last-named company created a good impression in view of the higher net profits. Dealings in Monsanto Chemicals preference shares ranged from 21s. 9d. to 22s. 3d., and Lawes Chemical transferred at 8s. at one time. General Refractories were higher at 9s. on the results, the resumption of dividends not having been anticipated in the market. Amalgamated Metal ordinary shares were around par, awaiting the dividend announcement. Borax Consolidated at 27s. 6d. were only slightly lower on the week. Movements in iron and steel shares were small but mostly against holders. Bryant and May preference shares were quoted slightly lower at 60s. "middle" but Swedish Match at 15s. 7½d. held most of their recent improvement. British Match were around 36s. 3d. Dunlop Rubber continued to show moderate fluctuations in advance of the dividend announcement.

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United Molasses were lower, but Triplex Glass were not affected very much by the general trend of the stock and share market, and, awaiting the financial results, United Glass Bottle and Canning Town Glass shares had a steady appearance. Boots Drug were a firm feature at 42s. 9d., but Beechams Pills deferred were easier at 8s. Wall Paper deferred at 18s. 3d. lost part of the improvement shown last week. Cooper McDougall were 23s. 1½d. "ex" the dividend. Pinchin Johnson went back moderately, but Lewis Berger were higher at 48s. 9d. pending the interim dividend, while Indestructible Paint and other paint shares were steady. "Shell" and most leading oil shares showed small movements against holders.